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ABSTRACT

A project was undertaken at Florida Technological University in 1974-75 to establish a procedure for determining discipline productivity factors for the internal allocation of instructional faculty resources. A theoretical model for faculty allocation was developed, independent of discipline, and student credit-hour productivity factors were established by discipline. Finally, the number of faculty members allocated by the theoretical model and the number allocated by the traditional method were contrasted. It appeared that in some areas, inequities had occurred in the past among the various disciplines. However, most differences were minimal, and the changes made on the basis of the new model have not had serious impact on the colleges involved. (Author/MSE)

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A THEORETICAL APPROACH FOR INTERNAL ALLOCATION OF ACADEMIC PERSONNEL RESOURCES

Presented at

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Los Angeles, California

by

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ABSTRACT

This project was undertaken to establish a procedure for determining discipline productivity factors for the internal allocation of instructional faculty resources. The procedure was based on courses offered, purpose of course, and actual student credit hours generated.

The specific purposes of this study were:

1. To develop a theoretical model for the allocation of instructional faculty resources independent of discipline.
2. To develop Student Credit Hour (SCH) productivity factors by discipline.
3. To contrast the number of faculty members allocated by the theoretical model and the traditional model.

The study was initiated and completed at Florida Technological University during the 1974-75 School Year. The development of the model consisted of the following basic steps:

1. Determine those factors which seemed most important when calculating instructional faculty need.
2. Establish a foundation from which all parties could function.
3. Establish instructional modes and discipline productivity factors by level.

Once appropriate productivity factors were established, a comparison between the number of faculty needed and the number of faculty allocated by discipline and level was completed. This analysis evidenced that in some areas inequities had occurred in the past among the various disciplines. However, most changes were minimal and the combined impact on any one college was not serious.

This model provides a viable alternative for the internal allocation of faculty at the college level. The procedure is reasonably objective, easily understood, and considers important factors and considers optimum use of faculty resources.

Overview

The conflicting pressures confronting higher educational institutions are immense. Institutions are confronted with static or declining budgets, a reduction in growth rate, and diverse changing program needs. At the same time, institutional administrators must determine ways to maintain strong programs and strengthen the quality of others within this environment. Quality programs are probably more closely related to adequate faculty resources than any other factor. Although the equitable allocation of instructional faculty is a perplexing and difficult problem, procedures must be developed to ensure that faculty needs are closely matched with actual allocated faculty resources.

This project was undertaken at Florida Technological University to establish a procedure for determining discipline productivity factors (average number of student credit hours per full-time equivalent faculty member) for the internal allocation of instructional faculty resources. An effort was made to develop a management tool for allocating faculty resources based on courses offered, purpose of course, and actual student credit hours generated. The approach is reasonably objective, easily understood, and not subject to manipulation.

The specific purposes of this study were:

1. To develop a theoretical model for the allocation of instructional faculty resources independent of discipline.
2. To develop Student Credit Hour (SCH) productivity factors by discipline.
3. To contrast the number of faculty members allocated by the theoretical model and the traditional model.

The authors wish to express appreciation to the faculty, chairpersons, and deans who shared their experience and expertise in developing the parameters of this project; to Dr. C. B. Gambrell, Vice President of Academic Affairs, for his patience, support, and willingness to experiment with new and innovative procedures. Last, but not least, appreciation is expressed to Beverly Dutton, Systems Analyst, who effectively developed the computer program to make this possible.

Historical Development

The equitable allocation of instructional faculty resources has always been a problem for academic administrators. In 1974, Counelis reported that a review of common allocation procedures did not provide an adequate conceptualized treatment of the matter (Counelis, 1974). Although most academic planners will indicate that instructional faculty resource needs must be based on number of students and level of students, as well as purpose and pedagogical aspects of the academic unit, a review of the literature did not reveal this to be the practice. The article published in the Chronicle of Higher Education which addressed the budget allocation controversy between Vice Chancellor Day and Dean Silverman appears to be an ideal example of a model that did not incorporate all of the essential components. Day assumed that all credit hours generated at the same level should be considered equivalent for the purpose of assessing faculty need. He was accused by Silverman and others of not taking into consideration the special nature of individual programs and disciplines. Implementation of the "Modest Proposal" which was recommended by Day would have resulted in the reallocation of 150 faculty positions from two divisions to three other divisions (Magarrell, 1975).

Dressel cited that the main purpose of an allocation model is to make possible the optimum use of resources according to a set of objectives (Dressel, 1971). This principle must be kept in mind when developing any model or procedure for allocating instructional faculty resources. When allocating faculty resources among the various academic units accurate estimates must be established between program offerings and desired outcomes.

A review of the common approaches used in allocating faculty resources revealed that when models are utilized, the need for positions for instruction, research, service, counseling, and administration are usually determined by different criteria and procedures. Moreover, procedures being used do not attempt

to optimize the use of resources in accordance with stated objectives unless one assumes the objectives are directly reflected in the historical productivity figures. Most of the efforts used to allocate faculty resources have been based on subjective judgements of academic officers or discipline averages. Accordingly, only historical data have been used to establish these averages. The traditional models used to allocate faculty resources for direct instruction, parallel one of the following three types:

1. An allocation based on system-wide average.
2. An allocation based on historical data at the institution.
3. An allocation based on subjective judgement of an academic officer.

An analysis of the three procedures reveals severe limitations with each. When system-wide averages are used at the institutional level, the model is not sensitive to the unique characteristics of institutional programs or the specific objectives established for the program. One institution may be phasing out a weak program while a second institution may be strengthening a program in the same discipline. On the other hand, a program at one institution may offer only general education courses while the corresponding program at other institutions may only provide courses for a specialized major. When allocations are based solely on historical averages, either institutional or statewide, the model tends to repeat the mistakes of the past and perpetuate staffing inequities. This procedure is further complicated because productivity factors used over a period of time acquire a level of acceptance and permanence. These discipline productivity factors remain very static regardless of what is being taught, how it is being taught, or what is to be accomplished. The model that is based on subjective judgements of an academic officer has the potential of being the best or worst method for allocating instructional faculty resources. Although this could be an effective, efficient approach, its effectiveness may only be realized when the academic officer has the experience, intuition, and confidence of the faculty, as well as a finely "tuned crystal ball."

Regardless of the model used, a successful allocation procedure must provide a way to identify differences and similarities among disciplines. When a model is used for statewide use, it must have the capacity to differentiate between substantially different programs in the same discipline throughout the system.

Model Development

In an attempt to add more objectivity and equitableness to the determination of discipline productivity factors for the allocation of instructional faculty resources and to avoid the difficulties and pitfalls which appear to exist with current models, an alternate approach was undertaken which utilized four basic allocation model requirements (Bolte, 1974) and involved on-campus input from each department and dean. These requirements are as follows:

1. The model must reflect institutional goals and policy decisions.
2. The model must reflect the areas of actual resource usage.
3. The model must be based on factors which are general.
4. The model must be adaptable to mathematical formulation which is easily understood by the resource user.

The study was initiated and completed during the 1974-75 school year.

The first step was to determine those factors which seemed most important in addressing instructional faculty needs. The following three factors were identified which relate directly to faculty resource need:

1. Course Instructional Mode. This factor refers to the method by which a course can be reasonably and effectively taught. Some of the common instructional modes are lecture, lecture-discussion, lecture-laboratory, laboratory, seminar, and intern supervision.
2. Course Instructional Level. This factor refers to the conventional levels of lower division, upper division, and graduate.
3. Purpose of Course. This factor refers to whether the course is taught primarily as a general education offering or if it is intended for a major program of study.

In the second step, it was necessary to establish a foundation from which all parties could function. Three assumptions were made and agreed on by those involved in the project. They are as follows:

1. Appropriate modes of instruction could be identified which describe the instructional methods used in courses offered at the university.
2. Average class size is dependent on mode of instruction, level of course, and purpose of course, but it is independent of the discipline in which the course is taught. For example, the astronomy and general psychology courses offered to satisfy basic general education requirements and taught by the lecture mode of instruction, should have the same average class size even though the courses are offered by different disciplines.
3. Consensus could be reached on an average class size which would optimize the use of faculty resources while maintaining a high level of instructional quality for each mode of instruction.

The third step of the project was to develop the productivity factors. With the factors identified in Step 1 and the basic assumptions in mind, the following tasks were completed to establish discipline productivity factors by level. These tasks were accomplished through a series of meetings with deans, department chairpersons, and faculty over a period of about six months and through analysis of university programs, induced course load matrices, and other student credit hour data.

Task 1. Establish Modes of Instruction. This phase involved establishing a basic list of instructional modes and then expanding the list to meet the specific needs of the university. The basic instructional mode list was circulated primarily to department chairpersons. They were asked to determine if each of their course offerings could be assigned one of the instructional modes. When a chairperson identified courses which did not fit into these modes, additional modes were added. The final list included 34 different instructional modes when

purpose and level were incorporated in the scheme. Perhaps the most important outcome of identifying additional modes was that no chairperson or faculty member felt that courses were being forced into an inappropriate classification. Table 1 provides a complete list of the instructional modes by level and purpose as developed in this project.

Task 2. Assign Instructional Modes. This phase involved assigning an appropriate mode of instruction to each course offering. Since course level was obvious, the primary task was to review the basic purpose of the course as it related to the entire university program and select the appropriate mode of instruction to maintain consistency across the various disciplines. The only serious problem in completing this task was to identify and correct obvious inconsistencies in recommended course placement. As would be expected, some preferred to teach all of their courses in a small class mode while wistfully ignoring faculty resource limitations and alternate, effective educational delivery systems. After consultation with the deans and chairpersons these inconsistencies were overcome. Some instructional modes were eliminated. After analyzing the stated purpose of the course with the chairperson and dean, it was judged that one could not justify the method of instruction.

Task 3. Establish Expected Average Class Sizes. Since research indicates there is no ideal class size for either student achievement or instructional delivery (Murphy, 1975), this phase required participants to use subjective judgements and experience to establish an average class size for each mode of instruction, level of course, and purpose of course. Figures were agreed on which make possible the optimum utilization of faculty resources while maintaining a high level of instructional quality. Based on wide experience with the various modes of instruction and the purpose of course offerings, a consensus was attained on an acceptable class size without anyone being heavily biased by personal references to a course within a particular area. In the final analysis,

TABLE 1

INSTRUCTIONAL MODES, AVERAGE CLASS SIZES,
AND PRODUCTIVITY FACTORS BY
LEVEL AND CLASS PURPOSE

MODE	CLASS SIZE	PRODUCTIVITY FACTOR
Lower Service (General Education)		
1. Lecture	90	1080
2. Lecture (Discussion)	50	600
3. Lecture (Discussion and Problem Solving)	40	480
4. Lecture (Writing or Speaking)	25	300
5. Lecture/Lab	90/24	540
Lower Major (Major within dept. or another dept.)		
1. Lecture (Discussion)	40	480
2. Lecture (Discussion/Lab)	40/20	320
3. Lecture (Discussion and Problem Solving or Activity)	32	384
4. Lecture (Writing or Speaking)	25	300
5. Lecture and Lessons (Music Dept. only)	10	120
6. Studio	25	300
7. Lab	20	160
Upper Service (General Education)		
1. Lecture	60	720
2. Lecture/Recitation	120/30	720
3. Lecture/Lab	48/24	385
4. Lecture/Studio	48/24	385
5. Lecture (Writing and Speaking)	25	300
6. Lecture (Case Method)	32	384
7. Lecture/Student Activity	48/24	385
8. Music Performance	50	400
Upper Major (Major within dept. or another dept.)		
1. Lecture (Discussion)	34	408
2. Lecture (Discussion and Problem Solving)	28	336
3. Lecture (Discussion and Problem Solving/Lab)	28/14	224
4. Lecture (Discussion and Student Presentation or Activity)	34	408
5. Lecture (Discussion and Field Projects)	30	360
6. Lecture (Discussion/Lab)	34/17	272
7. Lecture (Discussion/Student Activity)	34/17	312
8. Lecture (Writing or Speaking)	25	300
9. Lecture (Case Method)	28	336
10. Lab and Clinical	15	120
11. Studio	20	240
12. Seminar	20	240
13. Lecture and Lessons (Music Dept. only)	10	120
14. Supervision	20	240

class sizes were pushed downward by a general desire to teach small classes where a greater exchange of ideas can take place and were pushed upward by the realization that only a limited number of faculty positions would be available.

Task 4. Establish Student Credit Hour Productivity Factors. A student credit hour productivity factor was established for each mode of instruction, level of course, and purpose of course directly from the expected class size. Since a full-time instructional faculty member in the State University System of Florida would normally teach approximately 12 credit hours, the product of 12 times the average class size yields an expected productivity factor for most modes of instruction. Weightings were applied for modes of instruction such as laboratories where contact hours greatly exceed the number of course credit hours. However, the weightings were purposefully limited to not more than one and one-half equivalent credit hours for each assigned laboratory credit hour. Table 1, Column 3 provides a complete list of these figures.

Task 5. Calculate the Required Faculty. The required number of faculty that would have been needed to teach the courses that were offered during the previous two years was computed for each discipline and level as if all courses had been taught in the assigned instruction mode. These figures were obtained by dividing the credit hours generated in each course by the prescribed productivity factors (Table 1, Column 3). Data for the two-year period were utilized to assure that all courses typically taught at the university would be included and to assure reasonable stability in average productivity factors from one year to the next.

Task 6. Calculate Average Productivity Factors. The number of student credit hours per full-time equivalent instructional faculty was determined for each discipline and level. This step was accomplished by dividing the aggregate number of student credit hours generated by level and discipline for the previous

two years by the aggregate number of required faculty (determined in Task 5). The quotients represent the weighted productivity factors for each discipline level. Once student credit hour projections become available for the following year, these productivity factors can be used to estimate instructional faculty needs. This procedure assumes a similar mix among course offerings from year to year. An analysis was completed of productivity factors for the 1972-74 and 1973-75 periods. A Chi-square analysis at the five percent level of significance did not reveal that productivity factors were dependent on year. Therefore, it can be assumed that a high degree of stability can be anticipated with the procedure. Table 2 provides an illustration of the procedure used to determine a discipline productivity factor. Calculations for all discipline productivity factors were made by using the course offered inventory, data base, and a COBOL program.

It is important to note that although this procedure utilizes historical data, the procedure in no way perpetuates previous inequities or arbitrary choices made by the department chairperson or dean. The procedure uses historical student credit hour data only to establish the mix of student credit hours among various instructional modes which a given discipline has generated and is likely to generate during the next succeeding year. Changes in mix will be reflected in subsequent year productivity factors, but the changes will be invariably small. By using data for the two previous years, the complete impact of a change in course mix will be realized by the second recalculation.

A particularly important and clear advantage of the procedure is that it permits faculty, department chairpersons, and deans to readily identify one of the reasons for varying productivity factors across the disciplines in the university.

TABLE 2

SAMPLE CALCULATION OF A DISCIPLINE
PRODUCTIVITY FACTOR

Course	Mode	Productivity Level	Student Credit Hours Generated			Faculty Required
			1973-74	1974-75	total	
COM 100	LS01	1080	978	1476	2454	2.270
SPE 101	LS04	300	3195	3252	6447	21.490
SPE 102	LM07	160	109	28	137	.856
SPE 261	LM02	320	120	275	395	1.234
SPE 262	LM01	480	32	0	32	.067
Discipline	N/A	Total	N/A	N/A	9465	25.917

$$\text{Productivity Factor} = \frac{\text{Total SCH}}{\text{Total Faculty Required}} = \frac{9465}{25.917} = 365.2 = 365$$

Note: The computer program and documentation may be obtained by contacting J. R. Bolte or D. R. Coleman.

Comparative Analysis

An analysis of the productivity factors and number of positions generated by the model was undertaken to assess the impact of the model on each discipline and on the total faculty allocation. A comparison between the previous and the model generated productivity factors was completed to determine if differences could be justified. Also, a comparison between the number of faculty allocated with the previous productivity factors and the projected number of faculty needed when the model generated productivity factors were used was completed for each discipline.

Table 3 provides a listing of the productivity factors that were generated by using the previous and model generated factors. These factors were utilized to drive the University faculty resource allocation model A Chi-square analysis was used to test the null hypotheses of independence for both the lower and upper levels. Both null hypotheses were rejected at the five percent level of significance. Thus, one can conclude that the number of students per full-time equivalent faculty is dependent on the procedure for determining the productivity factor. A detailed analysis of the computed Chi-square components at the lower level revealed that nine of the values exceeded three. In each case the change in productivity factor was justifiable. An analysis between the expected and new productivity factors revealed that there was no homogeneity in the direction of change. This would indicate that a redistribution of faculty should occur. The analysis of the individual computed Chi-square values at the upper level revealed only one Chi-square value greater than three and five greater than one. Again the lack of homogeneity was observed and the changes were justifiable. For example, in the engineering discipline over 30 percent of the student credit hours were generated at the upper level in courses used only to satisfy advance general education requirements. These courses were similar to other courses assigned to the upper level service lecture mode of instruction. These findings

TABLE 3

PREVIOUS AND MODEL GENERATED
INSTRUCTIONAL PRODUCTIVITY FACTORS
BY DISCIPLINE AND LEVEL

Discipline	Lower Level		Upper Level	
	Previous	Model Generated	Previous	Model Generated
Bio.	400	365	250	296
Bus. Admin.	425	439	390	400
Comm.	350	365	325	314
Comp.	425	421	340	336
Educ.	400	438	390	351
Engr.	340	514	325	384
Fine Arts	200	201	200	228
For. Lang.	375	300	340	323
Hlth. Sci.	300	480	200	275
Letters	380	502	380	367
Math	475	415	340	335
Phy. Sci.	375	435	250	298
Psy.	525	748	400	363
Soc. Sci.	525	873	400	380

indicate that the productivity factor profiles are significantly different. However, the need to reallocate faculty to meet the instructional needs was justifiable in each instance.

Table 4 provides a distribution of the number of faculty generated by using the previous and model generated factors. A Chi-square analysis was used to test the null hypothesis of independence. These data did not reveal sufficient evidence to reject the null hypothesis at the five percent level of significance. Although there were minor differences in the number of faculty allocated by the two sets of factors, most changes proved to be minimal and the combined impact on any one discipline or college was not serious. To minimize the impact of adopting the new productivity factors, it was agreed that no productivity factor would be adjusted more than 10 percent.

Conclusion

The equitable allocation of resources and the ability to withstand scrutiny by those adversely affected are the ultimate tests of a resource allocation model. If the model is to have credibility and be accepted as a useful management tool, faculty and college administrators must be convinced that it will treat each department equitably.

The findings of this project indicate that it is possible to access need on the basis of how courses should be taught to provide quality instruction. Our experience indicates that faculty and administrators are willing to address the realities of budget limitations and adopt reasonable class size standards for each instructional mode. Although complete agreement was not attained, the procedure and the instructional productivity factors were accepted by the chairpersons and deans.

This procedure enables college personnel to determine why there are differences among the various discipline productivity factors. One additional advantage is that it would enable a board member or legislator to review a university's

TABLE 4

NUMBER OF GENERATED FACULTY USING
PREVIOUS AND MODEL GENERATED FACTORS

Discipline	Number of Faculty	
	Previous	Model Generated
Bio.	16.2	15.6
Bus. Admin.	50.7	49.7
Comm.	20.7	20.8
Comp.	10.7	10.8
Educ.	64.9	69.1
Engr.	37.1	31.4
Fine Arts	21.6	20.0
For. Lang.	4.4	5.2
Hlth. Sci.	8.2	6.6
Letters	32.0	29.2
Math.	21.3	22.6
Phy. Sci.	17.9	15.3
Psy.	18.6	18.0
Soc. Sci	35.2	33.1
Total	359.2	347.4

procedure for assessing instructional faculty needs in terms they can associate with their background and experience. The number of students per class and the number of classes taught per week are much more meaningful than a derived student credit hour figure.

As a result of this research, the authors believe a management tool for accessing instructional faculty resource needs has been developed. This procedure is reasonably objective, easily understood, considers important factors, and considers optimum use of faculty resources. Furthermore, the procedure is not manipulatable over a given period of time. The authors believe the procedure provides an equitable, objective method for assessing faculty needs and that it is readily adaptable to other institutions regardless of size.

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